

## CLAIMS

What is claimed is:

1. A power transfer apparatus for use in a four-wheel drive motor vehicle to transfer drive torque from a powertrain to first and second drivelines, comprising:

a first rotary member connected to the first driveline;

a second rotary member connected to the second driveline;

a bi-directional overrunning mode clutch having a first ring driven by said first rotary member, a second ring concentrically aligned with said first ring, rollers disposed in aligned cam tracks formed in facing surfaces of said first and second rings, said second ring adapted to index circumferentially relative to said first ring to cause said rollers to engage said cam tracks and frictionally couple said second rotary member for rotation with said first ring, and a mode actuator that is moveable between a first position and a second position to establish corresponding AUTO and LOCK modes, said mode clutch is operable in its AUTO mode to permit relative rotation between said first and second rotary members in a first direction and prevent relative rotation therebetween in a second direction, and said mode clutch is operable in its LOCK mode to prevent relative rotation between said first and second rotary members in both directions; and

a shift mechanism for moving said mode actuator between its first and second positions.

2. The power transfer apparatus of Claim 1 wherein said first rotary member includes a first output shaft connecting the powertrain to the first driveline and a transfer assembly connecting said first ring of said mode clutch for rotation with said first output shaft, and wherein said second rotary member includes a second output shaft connected to the second driveline, said second ring disposed between said first ring and said second output shaft such that indexing of said second ring relative to said first ring causes said rollers to engage said cam tracks for coupling said second ring for rotation with said first ring and coupling said second output shaft for rotation with said second ring.

3. The power transfer apparatus of Claim 2 wherein said first output shaft is a rear output shaft and said second output shaft is a front output shaft, and wherein said transfer assembly includes a first sprocket driven by said rear output shaft, a second sprocket surrounding said front output shaft, and a mechanism for connecting said first sprocket to said second sprocket, said first ring of said mode clutch being coupled to said second sprocket.

4. The power transfer apparatus of Claim 1 wherein said first rotary member includes a first output shaft connected the first driveline, and wherein said second rotary member includes a second output shaft connecting the powertrain to the second driveline and transfer assembly connecting said first ring of said mode clutch for rotation with said first output shaft, said second ring of said mode clutch disposed between said first ring and said second output shaft such that indexing of said second ring relative to said first ring causes said rollers to engage said cam tracks for coupling said second ring to said second output shaft and said first ring to said second ring.

5. The power transfer apparatus of Claim 1 wherein said second ring is a split ring defining an actuation slot having first and second edge surfaces, and wherein said mode actuator has a lug retained in said actuation slot of said split ring and which is moveable from a central position disengaged from said first and second edge surfaces in a first direction into engagement with said first edge surface and in a second direction into engagement with said second edge surface.

6. The power transfer apparatus of Claim 5 wherein said mode actuator has a rim on which a drag band is retained, said drag band having a pair of ends between which a cam member is retained, said cam member having a first segment operable to cause said drag band to exert a drag force on said rim of said mode actuator which causes circumferential indexing of said mode actuator in response to relative rotation between said first and second rings, said cam member further including a second segment operable to release said drag force from said mode actuator.

7. The power transfer apparatus of Claim 6 wherein said shift mechanism is operable for moving said cam member between a first position whereat its first segment engages said drag band and a second position whereat its second segment engages said drag band.

8. The power transfer apparatus of Claim 7 wherein said shift mechanism includes a drive mechanism operable to move said cam member between its first and second positions in response to movement between first and second positions, and an electric motor for moving said drive mechanism between its first and second positions.

9. The power transfer apparatus of Claim 1 further comprising:

a power-operated actuator for controlling movement of said shift mechanism;

a mode selector for permitting an operator to select one of an on-demand four-wheel drive mode and a part-time four-wheel drive mode; and

a controller receiving mode signals from said mode selector and controlling actuation of said power-operated actuator in response to said mode signals.

10. The power transfer apparatus of Claim 9 wherein said power-operated actuator includes:

an electric motor receiving control signals from said controller; and

a drive mechanism operably interconnected to said mode actuator, said electric motor operable for causing movement of said mode actuator so as to shift said mode clutch between its AUTO and LOCK modes.

11. A transfer case comprising:

- an input shaft;
- a reduction unit driven by said input shaft and having an output member driven at a reduced speed relative to said input shaft;
- a first output shaft,
- a second output shaft;
- a range actuator moveable between a first position and a second position to establish corresponding drive connections between said first output shaft and each of said input shaft and said output member;
- a bi-directional overrunning mode clutch including a first ring driven by said first output shaft, a second ring, rollers disposed in aligned cam tracks formed in facing surfaces of said first and second rings, said second ring adapted to circumferentially index relative to said first ring to cause said rollers to ride up said cam tracks and cause said second ring to frictionally engage said second output shaft, and a mode actuator that is moveable between a first position and a second position to establish corresponding AUTO and LOCK modes, said overrunning clutch is operable in its AUTO mode to permit relative rotation between said rear and front output shafts in a first direction and prevent relative rotation therebetween in a second direction, and said overrunning clutch is operable in its LOCK mode to prevent relative rotation between said rear and front output shafts in both directions; and
- a shift mechanism for controlling movement of said range actuator and said mode actuator.

12. The transfer case of Claim 11 wherein said second ring is a split ring defining an actuation slot having first and second edge surfaces, said mode actuator is an actuator ring having a lug retained in said actuation slot of said split ring and which is moveable from a central position disengaged from said first and second edge surfaces in a first direction into engagement with said first edge surface and in a second direction into engagement with said second edge surface.

13. The transfer case of Claim 12 wherein said actuator ring has a rim on which a drag band is retained, said drag band having a pair of ends between which a cam member is retained, said cam member having a first segment operable to cause said drag band to exert a drag force on said rim of said actuator ring which causes circumferential indexing of said actuator ring in response to relative rotation between said first and second rings, said cam member further including a second segment operable to release said drag force from said actuator ring.

14. The transfer case of Claim 13 wherein said shift mechanism is operable for moving said cam member between a first position whereat its first segment engages said drag band and a second position whereat its second segment engages said drag band.

15. The transfer case of Claim 14 wherein said shift mechanism includes a drive member operable to move said cam member between its first and second positions and an electric motor for moving said drive member.

16. The transfer case of Claim 11 further comprising:

a power-operated actuator for controlling movement of said shift mechanism;

a mode selector permitting an operator to select one of an on-demand four-wheel drive mode and a part-time four-wheel drive mode; and

a controller receiving mode signals from said mode selector and controlling actuation of said power-operated actuator in response to said mode signals.



17. A controllable, multi-mode, bi-directional overrunning clutch assembly adapted for use in a transfer case for transferring drive torque from a primary output shaft to a secondary output shaft so as to establish a four-wheel drive mode, comprising:

a first ring journaled on a first rotary member and split to define an actuation channel having a pair of spaced end segments, a second ring fixed to a second rotary member, a plurality of rollers disposed in opposed cam tracks formed between said first and second rings, and an actuator ring moveable between positions engaged with and released from the end segments of said first ring; and

a shift system having a moveable clutch actuator which controls movement of said actuator ring for establishing an on-demand four-wheel drive mode and a locked or part-time four-wheel drive mode.